Small Business Innovation Research/Small Business Tech Transfer

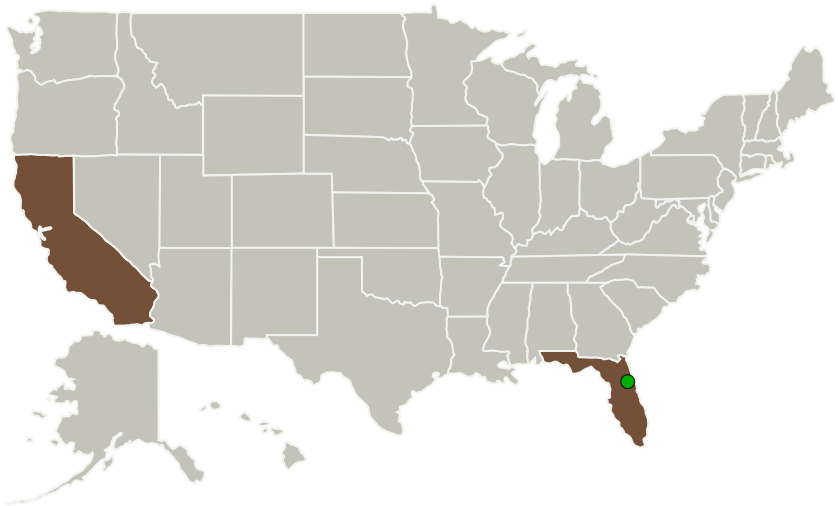
UAS Flight Planning Tool for Atmospheric Energy Extraction, Phase I

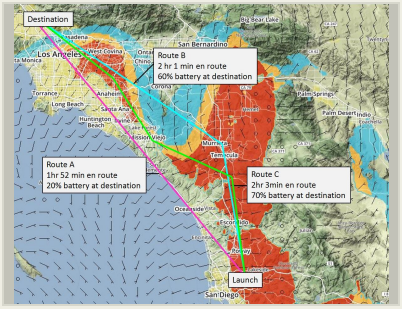
Completed Technology Project (2016 - 2016)

Project Introduction

Aircraft have been flying point to point missions for the past 100 years. Each flight, the fuel energy is burned based upon an assumed time requirement to transport people from one point to another as quickly as possible. Unmanned aerial vehicles do not share this constraint, and many proposed future electric unmanned aerial vehicle missions do not include time from the ground station to the area of interest as a limiting factor. These missions typically list battery life and sensor space inside UAV's as the limiting factors. By adjusting the path flown and exploiting atmospheric energy, air vehicles could potentially fly indefinitely, and/or greatly improve their duration and range. The following are a few of the benefits that will be possible by utilizing these techniques with a UAV: 1. Fixed wing unmanned electric aircraft could reduce battery weight and exchange it for additional payload capabilities. 2. Winged VTOL (i.e Swift Engineering's X-Blade) aircraft could arrive on station with full batteries, allowing sustained hovering flight. 3. Energy regeneration by the back-driving of the electric motors. 4. Increased speed en route by flying in lift rather than sink. Full-scale sailplane pilots use various weather and soaring forecast tools to aid in planning when and where the best conditions will exist for soaring flight. A flight planning tool using a flight simulator with integrated soaring and weather forecasts would run through the entire flight, for several flight paths, and display the important information as the flight unfolds. Plots of battery state, ground speed, GPS position, altitude vs. time, and others would be displayed to showcase the advantages of flying specific flight profiles. The design, build, and initial flight testing of this simulator tool are the focus of this research which will provide increased capability for any UAV that does not have point to point requirements and may need to survey remote locations.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Swift Engineering, Inc.	Lead Organization	Industry	San Clemente, California
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
California	Florida

Project Transitions

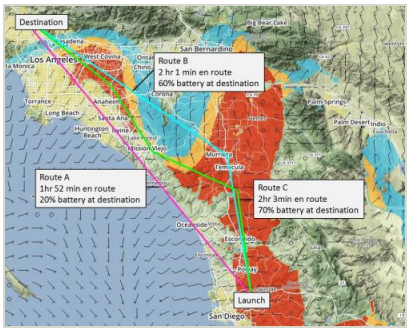
June 2016: Project Start

December 2016: Closed out

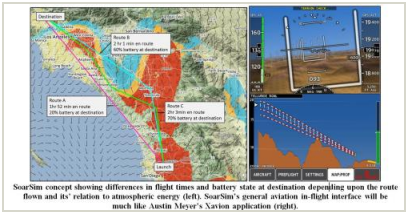
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137738)*

Images



Briefing Chart Image
UAS Flight Planning Tool for Atmospheric Energy Extraction, Phase I
(https://techport.nasa.gov/image/135174)



SoarSim concept showing differences in flight times and battery state at destination depending upon the route flown and its' relation to atmospheric energy (left). SoarSim's general aviation in-flight interface will be much like Austin Meyer's Xavion application (right).

Final Summary Chart Image
UAS Flight Planning Tool for Atmospheric Energy Extraction, Phase I Project Image
(https://techport.nasa.gov/image/130006)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Swift Engineering, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

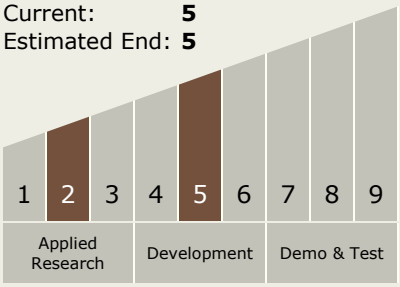
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Blake Poe

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System